WHAT IS CLAIMED IS:

1. A method for initiating and sustaining a combustive reaction in a solid fuel, said method comprising:

generating at least one pulsed optical signal;

directing the pulsed optical signal to a plurality of ignition points within at least one combustion chamber containing a solid fuel;

modulating the pulsed optical signal to initially have a first peak power sufficient to initiate a combustive reaction in a solid fuel; and

modulating the pulsed optical signal to subsequently have a second peak power sufficient to sustain the combustive reaction once the combustive reaction is initiated.

2. The method of Claim 1, wherein directing the pulsed optical signal comprises utilizing an optical fiber coupler including a plurality of optical fibers to transmit the pulsed optical signal to the plurality of ignition points.

3. The method of Claim 1, wherein generating at least one pulsed optical signal comprises generating a plurality of pulsed optical signals.

4. The method of Claim 3, wherein directing the pulsed optical signal comprises directing each of the pulsed optical signals to at least one of the multiple ignition points.

5. The method of Claim 1, wherein generating at least one pulsed optical signal comprises generating the pulsed optical signal to have a wavelength sufficiently short so that absorption of the pulsed optical signal by the solid fuel leads to molecular disassociation of the solid fuel.

6. The method of Claim 1, wherein generating at least one pulsed optical signal comprises generating the pulsed optical signal to have a duration sufficiently short so that the signal will have sufficient energy to generate the combustive reaction of the solid fuel.

7. The method of Claim 1, wherein modulating the pulsed optical signal to initially have a first peak power comprises modulating the pulsed optical signal to

have a first portion having a peak power sufficient to initiate a combustive reaction in a solid fuel.

8. The method of Claim 7, wherein modulating the pulsed optical signal to have a second peak power comprises modulating the pulsed optical signal to have a second portion having a peak power sufficient to sustain the combustive reaction until sufficient exothermic energy is released by the combustive reaction to make the reaction self-sustaining.

9. The method of Claim 1, wherein modulating the pulsed optical signal to initially have a first peak power comprises modulating a plurality of pulsed optical signals wherein a first pulsed optical signal has a peak power sufficient to initiate a combustive reaction in a solid fuel.

10. The method of Claim 9, wherein modulating the pulsed optical signal to have a second peak power comprises modulating at least one second pulsed optical signal generated subsequent to the first pulsed optical signal to have a peak power sufficient to sustain the combustive reaction until sufficient exothermic energy is released by the combustive reaction to make the reaction self-sustaining.

11. The method of Claim 10, wherein generating at least one pulsed optical signal comprises generating the first pulsed optical signal a predetermined time prior to generating the second pulsed optical signal so that all the energy of the second pulsed optical signal will be uniformly absorbed by the solid fuel without causing undesirable optical processes to interfere with the initiation of the combustive reaction.

12. The method of Claim 1, wherein modulating the pulsed optical signal comprises modulating the pulsed optical signal in accordance with the equation:

$$I_{cr}=\{mcE_I(1+(\omega\tau)^2]/[2\pi e^2\tau]\}[g+1/\tau_p \log_e(\rho_{cr}/\rho_0)]$$

where $\rho_{cr}$ is the critical electron number for breakdown, $\tau_p$ is the laser pulse width; m, e, c are the electron constants; $\omega$ is the optical field frequency; $E_I$ is the ionization energy of the solid fuel or an oxidizer; $\tau$ is the momentum transfer collision time; g is the electron loss rate; and $\rho_0$ is the initial electron density.

13. A propulsion system comprising:

at least one combustion chamber adapted to receive a solid fuel and oxidizer mixture;

at least one optical source adapted to generate at least one pulsed optical signal;

an intensity profiler adapted to modulate the pulsed optical signal to have a first peak power sufficient to initiate a combustive reaction of the solid fuel and a second peak power sufficient to sustain the combustive reaction until sufficient exothermic energy is released by the combustive reaction to make the reaction self-sustaining; and

an optical fiber coupler adapted to direct the pulsed optical signal to a plurality of ignition points within the combustion chamber.

14. The system of Claim 13, wherein the optical fiber coupler comprises an optical splitter adapted to divide the pulsed optical signal into a plurality of pulsed optical signal transmit via a plurality of optical fibers to the plurality of ignition points.

15. The system of Claim 13, wherein the optical fiber coupler comprises a bundle of optical fibers interconnecting the optical source and the combustion chamber and adapted to direct the pulsed optical signal to the plurality of ignition points.

16. The system of Claim 13, wherein the intensity profiler is further adapted to modulate the pulsed optical signal to have a first portion having a peak power sufficient to initiate a combustive reaction in a solid fuel.

17. The system of Claim 16, wherein the intensity profiler is further adapted to modulate the pulsed optical signal to have a second portion having a peak power sufficient to sustain the combustive reaction until sufficient exothermic energy is released by the combustive reaction to make the reaction self-sustaining.

18. The system of Claim 13, wherein the intensity profiler is further adapted to modulate a first pulsed optical signal generated by the optical source to have a peak power sufficient to initiate a combustive reaction in a solid fuel.

19. The system of Claim 18, wherein the intensity profiler is further adapted to modulate at least one second pulsed optical signal generated subsequent to the first signal to have a peak power sufficient to sustain the combustive reaction until sufficient exothermic energy is released by the combustive reaction to make the reaction self-sustaining.

20. The system of Claim 19, wherein the optical source is further adapted to generate the first pulsed optical signal a predetermined time prior to generating the second pulsed optical signal so that all the energy of the second pulsed optical signal will be uniformly absorbed by the solid fuel without causing undesirable optical processes to interfere with the initiation of the combustive reaction.

21. The system of Claim 20, wherein the predetermined time is less than approximately ten nanoseconds.

22. The system of Claim 13, wherein the intensity profiler is further adapted to modulate the pulsed optical signal in accordance with the equation:

$$I_{cr}=\{mcE_I(1+(\omega\tau)^2]/[2\pi e^2\tau]\}[g+1/\tau_p \log_e(\rho_{cr}/\rho_0)]$$

where $\rho_{cr}$ is the critical electron number for breakdown, $\tau_p$ is the laser pulse width; m, e, c are the electron constants; $\omega$ is the optical field frequency; $E_I$ is the ionization energy of the solid fuel or an oxidizer; $\tau$ is the momentum transfer collision time; g is the electron loss rate; and $\rho_0$ is the initial electron density.

23. The system of Claim 13, wherein the optical source is further adapted to generate the pulsed optical signal to have a wavelength sufficiently short so that absorption of the pulsed optical signal by the solid fuel leads to molecular disassociation of the solid fuel.

24. The system of Claim 23, wherein the wavelength is shorter than approximately 300 nanometers.

25. The system of Claim 13, wherein the optical source is further adapted to generate the pulsed optical signal to have a duration sufficiently short so that the signal will have sufficient energy to generate the combustive reaction of the solid fuel.

26. The system of Claim 25, wherein the duration of the duration is less than approximately three nanoseconds.

27. A method for initiating and sustaining a combustive reaction of a solid fuel contained in a combustion chamber, said method comprising:

generating at least one pulsed optical signal;

directing the pulsed optical signal to a plurality of ignition points within the combustion chamber;

initiating a combustive reaction of the solid fuel utilizing the pulsed optical signal modulated to have a first peak power sufficient to initiate a combustive reaction in a solid fuel; and

sustaining the combustive reaction of the solid fuel utilizing the pulsed optical signal modulated to have a second peak power sufficient to sustain the combustive reaction until sufficient exothermic energy is released by the to make the reaction self-sustaining.

28. The method of Claim 27, wherein directing the pulsed optical signal comprises utilizing an optical fiber coupler including a plurality of optical fibers to transmit the pulsed optical signal to the plurality of ignition points.

29. The method of Claim 27, wherein generating at least one pulsed optical signal comprises generating a plurality of pulsed optical signals.

30. The method of Claim 29, wherein directing the pulsed optical signal comprises directing each of the pulsed optical signals to at least one of the multiple ignition points.

31. The method of Claim 27, wherein generating at least one pulsed optical signal comprises generating the pulsed optical signal to have a wavelength sufficiently short so that absorption of the pulsed optical signal by the solid fuel leads to molecular disassociation of the solid fuel.

32. The method of Claim 27, wherein generating at least one pulsed optical signal comprises generating the pulsed optical signal to have a duration sufficiently short so that the signal will have sufficient energy to generate the combustive reaction of the solid fuel.

33. The method of Claim 27, wherein initiating a combustive reaction comprises modulating the pulsed optical signal to have a first portion having the first peak power sufficient to initiate a combustive reaction in a solid fuel.

34. The method of Claim 33, wherein sustaining the combustive reaction comprises modulating the pulsed optical signal to have a second portion having the second peak power sufficient to sustain the combustive reaction until sufficient exothermic energy is released by the combustive reaction to make the reaction self-sustaining.

35 The method of Claim 27, wherein initiating a combustive reaction comprises modulating a plurality of pulsed optical signals wherein a first pulsed optical signal has the first peak power sufficient to initiate a combustive reaction in a solid fuel.

36. The method of Claim 35, wherein sustaining the combustive reaction comprises modulating at least one second pulsed optical signal generated subsequent to the first pulsed optical signal to have a peak power sufficient to sustain the combustive reaction until sufficient exothermic energy is released by the combustive reaction to make the reaction self-sustaining.

37. The method of Claim 36, wherein the method further comprises generating the first pulsed optical signal a predetermined time prior to generating the second pulsed optical signal so that all the energy of the second pulsed optical signal will be uniformly absorbed by the solid fuel without causing undesirable optical processes to interfere with the initiation of the combustive reaction.

38. The method of Claim 27, wherein initiating and sustaining the combustive reaction comprises modulating the pulsed optical signal in accordance with the equation:

$$I_{cr}=\{mcE_I(1+(\omega\tau)^2]/[2\pi e^2\tau]\}[g+1/\tau_p \log_e(\rho_{cr}/\rho_0)]$$

where $\rho_{cr}$ is the critical electron number for breakdown, $\tau_p$ is the laser pulse width; m, e, c are the electron constants; $\omega$ is the optical field frequency; $E_I$ is the ionization energy of the solid fuel or an oxidizer; $\tau$ is the momentum transfer collision time; g is the electron loss rate; and $\rho_0$ is the initial electron density.